The Annals of Clinical and Analytical Medicine
Original Research

The risk factors of compensatory sweating in patients who have undergone one-stage bilateral single-port thoracoscopic sympathectomy for hyperhidrosis

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Abstract

Aim: Postoperative compensatory sweating is the most common recent complication ranging from 33% to 85%. Compensatory sweating is a concern and often precludes surgery as a definitive therapy. The aim of this study is to identify the risk factors for compensatory sweating on patients who have undergone one-stage bilateral single-port thoracoscopic sympathectomy for hyperhidrosis. Material and Method: From January 2011 to December 2017 one-stage bilateral single-port thoracoscopic sympathectomy was performed for focal hyperhidrosis in 154 patients. Follow-up data were obtained from hospital charts, and the patients were supposed to answer a detailed standard questionnaire by means of a telephone interview. The data including characteristics of patients, the Hyperhidrosis Disease Severity Scale (HDSS) score, duration of surgery, hospital stay, postoperative complications, compensatory sweating, recurrence of hyperhidrosis and patient satisfaction were collected. Binary Logistic Regression Analysis was practiced to assess the association with potential risk factors for compensatory sweating. Results: Ninety-one (59%) patients were male and 63 (41%) patients were female (age range 16–47 years, mean age 24 years). T2-T3 resection was performed on 29 (18.8%) patients with craniofacial and palmar hyperhidrosis. T3–T4 resection was performed on 125 (81.2%) patients with only palmar hyperhidrosis or axillary and palmar hyperhidrosis or axillary, palmar and pedal hyperhidrosis. Compensatory sweating occurred in 24 (15.5%) patients. When patients were asked to rate the severity of their compensatory sweating, the rate is -as moderate- that by eighteen patients (75%) and as severe by six patients (25%). No intolerable compensatory sweating was reported. According to the logistic regression analysis, T2-T3 sympathectomy (OR = 6.243, p = 0.030), axillary localization hyperhidrosis (OR = 3.345, p = 0.015), and HDSS score (OR = 8.854, p = 0.001) variables were identified as risk factors for compensatory sweating occurrence. Discussion: The axillary localization hyperhidrosis, T2-T3 sympathectomy, and high HDSS score were identified as risk factors for compensatory sweating occurrence. Patients with these risks should receive extensive information for postoperative compensatory sweating.

Keywords

Hyperhidrosis; Thoracoscopic Sympathectomy; Compensatory Sweating

DOI: 10.4328/ACAM.5991 Received: 02.08.2018 Accepted: 28.09.2018 Published Online: 02.10.2018 Printed: 01.09.2019 Ann Clin Anal Med 2019;10(5): 532-6
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Introduction

Hyperhidrosis is a condition characterized by sweating more than is required for normal thermoregulation. The principal characteristic of this disease is the intense discomfort of patients, which affects their social, affective, and professional life. Therapeutic options for its management include topical anti-perspirants, anti-cholinergic drugs, iontophoresis and recently, botulinum toxin injections [1]. Medical management is often frustrating and the response is usually transient. Surgical therapy is effective, especially for palmar hyperhidrosis, and it is based on the interruption of impulses' transmission from the sympathectic ganglia to the sweat glands [2]. Satisfactory results are reported all over the world after video-assisted thoracoscopic sympathectomy that is proved to be safe and effective [3,4]. However, the potential for adverse effects, particularly the development of compensatory sweating (CS), is a concern and often precludes surgery as a definitive therapy [5]. According to date, amongst all the different surgical approaches, post-surgical CS varies widely, ranging from 3% to 98% [6]. Nevertheless, only a few patients consider CS to be as bothersome as their original hyperhidrosis symptoms, corroborating the high level of patient satisfaction after sympathectomy [7].

The risk factors with regard to CS have been analyzed in very few studies. The aim of this study was to identify the risk factors for CS in patients who have undergone one-stage bilateral single-port thoracoscopic sympathectomy.

Material and Method

From January 2011 to December 2017 one-stage bilateral single-port thoracoscopic sympathectomy was performed for focal hyperhidrosis on 154 patients. All patients complained that the hyperhidrosis severely interfered with their work or social activities and all patients had tried conservative treatments without effect. The Hyperhidrosis Disease Severity Scale (HDSS) score questionnaire (Table 1) was used for the adequate selection of patients preoperatively [8]. We informed the patients about the primary focal hyperhidrosis prior to the operation regarding the hyperhidrosis, nature of surgery, the way how the surgery would be done and potential complications of it. A written informed consent was obtained from each patient.

Follow-up data were obtained from hospital charts, and the patients were supposed to answer a detailed standard questionnaire in a telephone interview. Patients satisfactions were evaluated using four-point scales coded as follows: 0 (very dissatisfied), 1 (dissatisfied), 2 (satisfied), and 3 (very satisfied). The same surgeon performed all the interviews, explaining the scales and possible experienced side effects. The data including characteristics of patients, HDSS score, duration of surgery, hospital stay, postoperative complications, CS, recurrence of hyperhidrosis and patient satisfaction were collected. Patients who could not be contacted after discharge were excluded from the study. Informed consent was obtained from all patients for inclusion in the scientific paper.

Table 1. Hyperhidrosis disease severity scale[8]

How would you rate the severity of your sweating?	
1. My sweating is never noticeable and never interferes with my daily activities	Mild
2. My sweating is tolerable but sometimes interferes with my daily activities	Moderate
3. My sweating is barely tolerable and frequently interferes with my daily activities	Severe
4. My sweating is intolerable and always interferes with my daily activities	İntolerable

Surgical Procedure

A preoperative chest radiograph was performed to exclude lung or pleural disorders. The same bilateral operation in one stage was performed for all patients. The procedure was performed under general anesthesia using a double lumen endotracheal tube. Monitoring included saturation, blood pressure, and electrocardiogram. A fingertip pulse oximeter probe was used to record the changing pattern of the plethysmographic curve on the operated side. The patient was placed on the operating table in a semi-sitting position with arms in abduction. After the lung on the operative side was deflated, a single, 1-cm-long incision was made for insertion of an 11 mm trocar (Karl Storz, Tuttlingen, Germany) into the pleural cavity at the third intercostal space in the midaxillary line. A straight forward 0-degree operating thoracoscope with an operating channel that permits the use of a diathermy hook (Karl Storz, Tuttlingen, Germany) was introduced. The dorsal sympathetic chain was identified as running down over the necks of the ribs. The stellate ganglion (T1) was avoided. A diathermy hook inserted through the thoracoscope was applied to the ganglia (T2, T3 or T3, T4) and the intervening sympathetic chain. The chain was divided with diathermy cautery after a gentle anterior traction on the nerve. Electrocautery ablation of accessory branches and Kuntz nerve, when present, was performed in all cases to prevent relapses.

Complete transection of the chain above and below the ganglia (sympathectomy) was validated by the presence of peripheral vasodilatation and an instant change in amplitude of the wave form patterns of the pulse oximeter, indicating an increase in circulation after sympathectomy. A temporary intra-operative 20F chest tube was inserted into the chest during closure of the incisional soft tissues but it was removed before tying down the skin closure suture. Contralateral sympathectomy was performed in a similar manner. In four patients, very thin adhesions that could easily be eliminated by electrocautery were encountered. A chest X-ray was performed in the recovery room after surgery to ascertain complete lung expansion and then again just before discharge. Postoperative analgesia was provided by Pethidine using a patient-controlled analgesia device.

Statistical analysis

Continuous variables were expressed as the mean ± standard deviation. Categorical variables were expressed as percentages. Binary Logistic Regression Analysis was used to assess the association with potential risk factors for CS. All calculations were performed using a commercially available statistical package (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Statistically significant differences were established at $p < 0.05$.

Results

One-stage bilateral single-port thoracoscopic sympathectomies were performed on 154 patients with focal primary hyperhidrosis. Ninety-one (59%) patients were male and 63 (41%)

patients were female (age range 16–47 years, mean age 24 years). Pre-operative fifteen patients (9.7%) reported an HDSS score of 2 (moderate symptoms), seventy-nine (51.2%) reported an HDSS score of 3 (severe symptoms) and sixty patients (38.9%) reported an HDSS score of 4 (intolerable symptoms). Palmar and axillary hyperhidrosis were the most common symptoms. Hyperhidrosis was observed in the axillary region in 38 (24.6%) patients, in the palmar region in 138 (89.6%), in the craniofacial region in 29 (18.8%), and in the pedal regions in 18 (11.7%) patients.

The mean operating time was 53 (range 20–88) minutes. T2-T3 resection was performed in 29 (18.8%) patients with craniofacial and palmar hyperhidrosis. T3–T4 resection was performed in 125 (81.2%) patients with only palmar hyperhidrosis or axillary and palmar hyperhidrosis or axiller, palmar and pedal hyperhidrosis. Horner syndrome occurred in one patient and disappeared after 3 months. Chylothorax occurred in one patient. Talc pleurodesis was performed after tube thoracostomy and chylothorax was regressed with conservative treatment. Postoperative chest radiographs illustrated minör unilateral pneumothorax in 8 patients that required draining for 24-36 hours in only 4 patients (2.5%). There was no significant relevance for constant residual pain after ten days postoperatively. None of the patients demonstrated chronic pain. There was no mortality in this study. The length of hospital stay was 2.4 days (average 1-8). Most of the patients presented with an improvement in hyperhidrosis. The initial cure rate was 95% (n=146). The results regarding hyperhidrosis and CS according to replies to questionnaire are presented in Table 2. Mean follow-up was 13 months, ranging from 2 months to 54 months.

CS occurred in 24 (15.5%) patients. When asked to rate the severity of their CS it was rated as moderate by eighteen patients (75%) and as severe by six patients (25%). No intolerable CS was reported. According to the logistic regression analysis (Table 3), T2-T3 sympathectomy (OR = 6.243, p = 0.030), axillary localization hyperhidrosis (OR = 3.345, p = 0.015), and HDSS score (OR = 8.854, p = 0.001) variables were identified as risk factors for CS occurrence.

Table 2. The result regarding hyperhidrosis and compensatory sweating

Questions	Answer	n (%)
Satisfaction scores	0 (very dissatisfied)	2 (1)
	1 (dissatisfied)	6 (4)
	2 (satisfied)	96 (62)
	3 (very satisfied)	50 (33)
Compensatory sweating	None	0 (0)
	Low	0 (0)
	Moderate	18 (75)
	Severe	6 (25)
	Very severe	0 (0)

Table 3. Logistic regression analysis of compensatory sweating

Variables	Odds ratio	P value	95% Confidence interval
Gender (female / Male)	0.566	0.502	0.108 – 2.978
Age	0.968	0.615	0.855 – 1.097
Smoking (Yes / No)	2.339	0.281	0.499 – 10.966
HDSS score	8.854	0.001	9.630 – 47.854
Family history (Yes / No)	2.769	0.340	0.341 – 22.472
Palmar localization	2.642	0.611	0.063 – 111.085
Axillar localization	3.345	0.015	1.250 – 9.078
T2-T3	6.243	0.030	1.141 – 277.055
T3-T4	4.165	0.411	0.139 – 125.073
Complication (Yes / No)	1.030	0.957	0.348 – 3.051

HDSS: Hyperhidrosis disease severity scale

Discussion

In this report, we showed that one-stage bilateral single-port thoracoscopic sympathectomy for palmar and axillary hyperhidrosis is a successful procedure with minimal invasiveness and few postoperative complications. In 2011, we started to perform surgery with a one-stage approach at our institution. One-stage surgery obtained low hospitalization costs, decreased the risk of complications and one single quick admission. It is known that a single-port thoracoscopic approach causes less postoperative pain, offers a shorter operation and recovery time. Better functional and cosmetic results of a truly minimally invasive single-port access compared with more conventional, but still frequently used bi- or tri-portal approaches render these multi-port strategies obsolete [9]. Previous studies showed that the overall intraoperative morbidity is nearly 0.2%, reporting complications during surgery and conversion to thoracotomy [10-12]. However, none of these issues were observed in our study. The chest tube was not inserted into the thoracic cavity at the end of surgery. In our reports, pneumothorax was the most common early complication (5% of patients), although only 2.5% of cases required pleural drainage. However, an exertion of continuous positive pressure for a few seconds in coordination with the anaesthesiologist during the suture of the skin and the application of a mild suction to the temporary chest tube are essential to prevent residual air and possible incomplete reexpansion of the lung [13,14].

We investigated whether variables such as age, gender, smoking habits, family history, HDSS score, hyperhidrosis localization, level of sympathectomy and complication could impact on CS incidence. We affirmed that the above mentioned variables did not affect CS occurrences, but HDSS score, level of sympathectomy and hyperhidrosis localization. According to the logistic regression analysis, high HDSS score, axillary localization hyperhidrosis and level of T2-T3 sympathectomy have a higher risk of presenting CS. Compensatory hyperhidrosis is the most common late complication, with a different incidence reported in previous studies, ranging from 33% to 85% [12,15], regardless of the number of ganglia removed [16], and showing a gradually decreasing intensity over the follow-up period. Compensatory hyperhidrosis severely diminishes the postoperative quality of life of the patient. According to findings reported in the literature, CS seems dependent upon the height of the sympathetic chain resection. CS is greater with T2-T4 resection than with T2 or T3 only or T2-T3 resection [17]. Limitation of the denervation level is the most commonly used method to decrease the incidence of complications and achieve satisfactory results [18-20].

The HDSS proofs a valuable asset for patient selection and quantification of the perceived severity of hyperhidrosis. Although not specifically designed for CS impact detection, preoperative HDSS score did affect CS occurrences in our study. Controversy exists as to which levels and how many levels of

sympathectomy ensure the highest success rate and carry the lowest incidence of CS. Lower level sympathectomy (T3 and/or T4) may decrease the incidence and severity of CS, but it may also be less effective than T2-T3 sympathectomy [21]. In thirteen studies, the overall incidence of CS was 78.54% in the T2 group, 69.15% in the T3 group and 41.99% in the T4 group, while the incidence of moderate-to-severe CS was 25.81%, 19.24% and 7.88% in the T2, T3, and T4 groups, respectively [22]. Garcia and Espania recommend intervention on the T2 ganglia for craniofacial hyperhidrosis, on the T3 ganglia for palmar hyperhidrosis, and on the T3 and T4 ganglia for combined palmar and axillary hyperhidrosis [23]. In our study, T2-3 resection was performed on 29 patients with craniofacial and palmar hyperhidrosis, T3-4 resection was performed on the other patients. The incidence of moderate-to-severe CS was 15.5% (24 of 154 patients). CS developed in 58.6% (17 of 29 patients) of T2-T3 resected patients. According to the logistic regression analysis, T2-T3 sympathectomy (OR = 6.243, p = 0.030) was identified as a risk factor for CS occurrence.

When primary hyperhidrosis does affect the axillae, patients have a higher risk of presenting CS. The published results do not provide a consensus regarding the most favorable technique, although treatment of axillary hyperhidrosis requires resection as far as T4 [24]. Indeed, this negative repercussion motivates patients negatively such as avoiding surgery. In a study of Apiliogullari and associates, all patients with CS were suffered from axillary sweating [25]. In our study, postoperative CS developed in 75% (18 of 24 patients) of patients with axillary sweating. The axillary localization hyperhidrosis (OR = 3.345, p = 0.015) was identified as risk factors for CS. According to this evidence, the patients with axillary sweating should be fully informed about the potential for CS.

In conclusion, our results suggest that one-stage bilateral single-port thoracoscopic sympathectomy is a fast, safe and minimally invasive treatment for primary hyperhidrosis. The axillary localization hyperhidrosis, T2-T3 sympathectomy, and high HDSS score were identified as risk factors for CS occurrence. Informative and thorough information should be provided to these patients.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:
Esme H, Duran FM. The risk factors of compensatory sweating in patients who have undergone one-stage bilateral single-port thoracoscopic sympathectomy for hyperhidrosis. Ann Clin Anal Med 2019;10(5): 532-6.